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Insight and neurocognitive functioning in bipolar subjects

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Abstract

Background: Insight concerning having a mental illness has been found to influence outcome and effectiveness of treatment. It has been studied mainly in the area of schizophrenia with few studies addressing other disorders. This study evaluates insight in individuals with bipolar disorder using the Scale to Assess Unawareness of Mental Disorder (SUMD), a comprehensive interview for evaluation of awareness of illness and attribution of symptoms. The hypothesis was that in bipolar disorder level of awareness may be associated with numerous factors including neurocognitive function, structural changes in the frontal lobes and hippocampus evaluated by MRI, neurocognitive status, severity of mania and other psychiatric symptoms and comorbid alcoholism.

Method: In order to evaluate this hypothesis 33 individuals with DSM-IV diagnosed bipolar disorder, some with and some without comorbid alcoholism, were administered the SUMD and a number of other procedures including a quantitative MRI measuring volume of the frontal lobes and hippocampus, a brief battery of neurocognitive tests, the Brief Psychiatric Rating Scale, and the Young Mania Rating Scale. The data were analyzed by comparing participants with and without alcoholism on these procedures using t tests and by linear multiple regression, with SUMD ratings of awareness and attribution as the dependent variables and variable sets from the other procedures administered as multivariate independent variables.

Results: The median score obtained from the SUMD for current awareness was in a range between full awareness and uncertainty concerning presence of a mental disorder. For attribution, the median score indicated that attribution was usually made to the illness itself. None of the differences between participants with and without comorbid alcoholism were significant for the SUMD awareness and attribution scores, neurocognitive or MRI variables. The multiple regression analyses only showed a significant degree of association between the SUMD awareness score and the Young Mania Rating Scale ($r^2 = .632$, $p < .05$). A stepwise analysis indicated that items assessing degree of insight, irritability, and sleep disturbance met criteria for entry into the regression equation. None of the regression analyses for the SUMD attribution item were significant.

Conclusions: Apparently unlike the case for schizophrenia, most of the participants, all of whom had bipolar disorder, were aware of their symptoms and correctly related them to a mental disorder. Hypotheses concerning the relationships between degree of unawareness and possible contributors to its development including comorbid alcoholism, cognitive dysfunction and structural reduction of gray matter in the frontal region and hippocampus, were not associated with degree of unawareness but symptoms of mania were significantly associated. The apparent reason for this result is that the sample obtained a SUMD modal awareness score of 1 or 2, reflecting the area between full awareness and uncertainty about having a mental disorder. None of the participants were rated as having a 5 response reflecting the belief that s/he does not have a mental disorder.

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1. Introduction

Insight has emerged as an important clinical phenomenon and a relevant outcome measure, especially in terms of treatment adherence [1]. Insight encompasses awareness of having an illness and its social impact, an attribution of recognizable symptoms of that illness and an appreciation of the need for treatment. In the procedure developed by Amador and Strauss called the "Scale to Assess Unawareness of Mental Disorder" (SUMD), a comprehensive assessment of insight is accomplished incorporating general awareness of mental disorder, and of the specific symptoms of hallucinations, delusions, thought disorder, inappropriate affect, unusual appearance, stereotypic or ritualistic behavior, poor social judgment, poor control of aggressive and sexual impulses, slow or impoverished speech, flat or blunt affect, avolition-apathy, anhedonia or asociality, poor attention, confusion-disorientation, unusual eye contact, and poor social relationships. For each of these topics, the patient is asked about awareness at the time of the evaluation and in the past. Attributions or how the individual explains the experience is also rated on a scale evaluating degree of attribution to a mental disorder. Thus, SUMD was used in the present study to provide a reasonably comprehensive assessment of insight.

Most studies of insight have been performed in the area of schizophrenia [3,4] in which insight deficits may be caused by impaired cognition through affecting the awareness of symptoms, as well as attribution of symptoms to an illness [5]. Acute psychosis can mainly affect insight through impaired reality testing. Regardless of etiology or mechanism, poor insight has been a well-known predictor of treatment non-adherence [2–5]. Amador et al [6] reported a moderate to severe lack of awareness of mental illness in more than 50% of patients with schizophrenia, schizoaffective and bipolar disorder, whereas approximately 30% were markedly unaware of the social consequences of their illness, and approximately 20% denied the need for or benefit of medication. In addition to treatment non-adherence, studies have found an association between poor insight and poor prognosis [2], involuntary hospitalization [3,4] and poor psychosocial functioning [6]. Insight studies in schizophrenia also found little change in insight even after resolution of acute psychotic symptoms, suggesting that it is primarily an independent phenomenon.

The few studies that are available in bipolar disorder [6–10] also suggest insight deficits are in some respects similar to those observed in schizophrenia. With regard to neurocognitive as well as insight deficits bipolar subjects demonstrate persistence of deficits during euthymic periods [11,12]. Similarly, impaired executive functioning frequently reported in schizophrenia, [13–16] has also been observed in bipolar subjects [17,12]. This impairment in executive functioning suggests prefrontal cortical deficits in patients with bipolar disorder or schizophrenia. In addition to prefrontal cortical deficits, a parietal lobe pathology is sometimes suggested by resemblance between insight deficits reported in psychotic disorders and anosognosia observed in patients with right hemispheric lesions [1].

Although several studies have analyzed the relationship between poor insight and neurocognitive functioning in schizophrenia [2,6,3,19], none has examined in detail the relationship among insight, brain structure and cognitive function in bipolar subjects. Also, alcoholism has been reported to be more common in bipolar subjects than any other Axis I syndrome [18] but no study has investigated the impact of excessive use of alcohol on insight in patients with bipolar disorder. Since alcohol dependence may have an impact on insight, bipolar patients with comorbid alcoholism may have greater impairment of insight than those without alcoholism. A neurobehavioral basis for this association is that it is possible that alcohol-induced atrophy of various brain regions and particularly a decrease in frontal lobe blood flow [19] may further enhance insight deficits in bipolar patients. This study will examine the relationships among poor insight, brain structure in several regions through use of quantitative MRI, neurocognitive deficits, symptom profile and the impact of excessive use of alcohol on insight in alcoholic versus non-alcoholic individuals with bipolar disorder.

Specific structural brain changes have been relatively well documented in schizophrenia but their presence in bipolar disorder is less well established [20]. Although imaging studies in bipolar subjects have reported a variety of anatomical and neurobiological deficits, most of the findings have been inconsistent. For example, while a number of studies have failed to observe deficits in cortical gray matter volume [21,22] a few studies have found significant reductions in prefrontal gray matter volume in bipolar subjects [23–26]. Such controversial results may be explained at least partially on the basis of small sample size, methodological differences, and comorbidities of the study subjects. For example, excessive use of alcohol; one of the most commonly reported comorbidities in bipolar subjects [27,18] may enhance preexisting brain deficits in this population. This view is supported by several studies that have reported similar structural deficits in chronic alcoholics and bipolar subjects. For example, prefrontal and hippocampal cortical deficits have been reported in chronic alcoholics [28,19,29–31] as well as bipolar subjects [32–37] whereas atrophy of the corpus callosum [28,19,29,30] has been primarily reported only in alcoholic subjects. These observations suggest that alcohol dependence can potentiate preexisting anatomical deficits that may further compromise neurocognitive function and therapeutic outcome in bipolar patients. To our knowledge, no study has formally examined structural brain deficits in alcoholic versus non-alcoholic bipolar subjects. This study assessed prefrontal and hippocampal volume in bipolar subjects with and without alcohol dependence. A correlation between insight, abstract and executive functioning in patients with schizophrenia has been found in one preliminary study exploring insight [35]. It was hoped that the present study would provide valuable

additional information that will supplement data from this previous study examining structural correlates of insight in bipolar disorder.

Specific hypotheses are that bipolar subjects comorbid with alcoholism will have more severe impairment of insight than bipolar subjects without alcohol dependence. There will also be an association between poor insight and neurocognitive deficits in all cases. We also predicted that bipolar participants with alcohol dependence will have reduced gray matter volume in prefrontal and hippocampal regions as compared to bipolar subjects without alcoholism. Severity of mania and other psychiatric symptoms as measured by the Young Mania Rating Scale (YMRS) [15] and the Brief Psychiatric Rating Scale should also be associated with impairment of insight as measured with the SUMD.

2. Method

2.1. Subjects

A power calculation was based on the primary hypothesis, predicting a difference in insight between bipolar only and bipolar comorbid alcoholism patients. Based on the data from the study of Amador, Flaum, et al., 1994 using the SUMD, bipolar patients are expected to have a mean Awareness of Mental Disorder item score (Item 1) of 1.7 ± 0.82. This item asks about general awareness of a mental disorder. The mean score of 1.7 is a value between clear awareness and uncertainty about whether one does or does not have a mental disorder. With our target sample size of 20 subjects in each group (overall n = 40), we can detect a difference in means of 0.7, with $\alpha = 0.05$ and power = 0.80. This difference would indicate a large effect size (0.8). This value indicates acceptable power to reject the null hypothesis. For the MRI part of the study, preliminary analyses indicated that fifteen subjects in each group would provide 80% power to detect a difference of 15.3 cubic cm. in volume at the $p < .05$ significance level, using a two-tailed t-test. We obtained a sample of 20 subjects.

Oversampling was done in an effort to recruit equally sized samples with and without alcoholism, but it was not possible to achieve this goal. Therefore, accounting for missing data, the sample consisted of as many as 33 subjects with a minimum of 26, but we could recruit only 9 cases without alcoholism. It is possible that this proportion is representative of VA predominantly male patients and so we proceeded with the data analyses with these sample sizes. The subgroups used in the data analysis did not differ significantly in age, educational level, or illness severity assessed with the DSM-IV General Adaptation Scale (GAS). All participants met DSM-IV-R criteria for Bipolar Disorder I or II and/or Alcohol Dependence based on administration of the Structured Clinical Interview for DSM-IV, Patient Version (SCID-P) by a reliable interviewer. Individuals with other diagnoses were excluded. All but two of the subjects were male, aged 18–65. For those having a history of alcohol abuse or alcohol dependence, sobriety from alcohol was required for a period of 1 month. The study was approved by our IRB and no subjects were enrolled without first signing an informed consent document. No procedures were completed prior to the consent document being read, understood, and signed by the subject. Consent was obtained immediately after a patient expressed interest in becoming a subject in the study, prior to the screening evaluation and baseline evaluations (psychiatric, physical). Subjects were reimbursed for taking the MRI scan.

2.2. Research design

Hypotheses were tested within a design which compared individuals all of whom had bipolar disorder and some of whom had comorbid alcoholism. The data analyses aimed at evaluating whether (1) mean scores derived from the SUMD of the total Current Awareness and Attribution scores differed significantly between subjects with and without comorbid alcoholism. (2) Structural MRI data will show that subjects with alcohol dependence will have significantly smaller prefrontal and hippocampal gray matter volume than will subjects without alcohol dependence. Statistical evaluation of these hypotheses will be accomplished using independent sample t-tests and nonparametric tests of group differences to evaluate the possibility that the distributions may not be normal. (3) Linear multiple regression analyses will show that there are significant associations between symptom rating, cognitive, and MRI data used as predictor variables and SUMD Unawareness of Symptoms and Current Misattributions for Symptoms summary scores considered as dependent measures. These analyses will be conducted with the total sample. Thus, the study addresses the matters of differences in individuals with bipolar disorder grouped according to presence or absence of comorbid alcoholism and of evaluating strength of association among gray matter brain volume in the hippocampus and frontal lobes, neurocognitive function, and psychiatric symptomatic status with performance on the SUMD, a validated measure of various aspects of unawareness of illness [36].

2.3. Procedures

SUMD: The SUMD is a 20 item structured interview procedure that evaluates various aspects of insight across several manifestations. It is divided into four subscales evaluating current awareness, current attribution, past awareness and past attribution. For purposes of the present study only the current subscales were used because of apparent lack of reliability of the past subscales. The first three items produce summary scores that assess general awareness of mental disorders, awareness of medication effects and of the social consequences of the disorder. The remaining items rate symptoms including hallucinations, delusions, thought disorder, inappropriate affect, unusual dress or appearance, stereotypic or ritualistic behavior, poor social judgment, poor control of aggressive impulses, poor

control of sexual influences, alogia, flat or blunt affect, avolition-apathy, anhedonia-asociality, poor attention, confusion-disorientation, unusual eye contact and poor social relationships. Each awareness and attribution item is rated on a six point scale ranging from 0 to 5. For the awareness section ratings range from 0 meaning item cannot be assessed or is not relevant to 5 indicating unawareness. For the attribution section the ratings range from 0 meaning cannot be assessed or not relevant to 5 indicating belief that symptom is unrelated to a mental disorder. Data analysis was accomplished using this six point scale for each individual item providing the median, mode, and range of scores for each item. These different measures of central tendency are given since the SUMD items are on an ordinal scale.

2.3.1. Neurocognitive assessment

Wisconsin Card sorting Test: Using a deck of cards containing pictures of geometric forms of different shapes, colors and sizes, the test assesses ability to identify concepts based upon experience and to shift conceptually. Impairment on this test has been specifically associated with dysfunction of the dorso-lateral surface of the prefrontal region, with strong support from neuroimaging and cerebral blood flow studies. The test yields many scores but the most widely used ones are the perseverative errors and categories completed scores. Perseverative errors are those in which the subject fails to shift to a relevant concept and categories completed is the number out of the six categories contained in the test that are successfully solved.

Short Form Wechsler Adult Scale of Intelligence (WASI): The WASI includes the Vocabulary, Block Design, Similarities and Matrix reasoning WAIS III subtests. Subtest scaled scores and Verbal, Performance and Full Scale IQs are provided.

The Behavioural Assessment of the Dysexecutive Syndrome (BADS) contains six subtests. Rule Shift requires the subject to initially go through a deck of cards, saying 'Yes' for red or 'No' for black cards. Then, the rule is shifted by asking the subject to tell whether the card just turned over is the same as or different from the previous card. In action sequences the subject attempts to remove a cork from a tube in a beaker filled with water using materials made available. The score is the number of problem solving stages completed independently. Key search assesses the subject's ability to plan an effective course of action to find a lost key. Temporal judgment asks questions about the duration of events, an ability that contributes to organizing and planning. The Zoo Map Test evaluates planning when constrained by a set of rules. The task is for the subject to plan to visit a series of locations on a map of a zoo while obeying a set of rules (e.g., starting at the entrance and finishing at a designated area). The Modified Six Elements Test requires the subject to perform a dictation, arithmetic, and picture naming task. The test is scored for organizing ability, including the number of sub-tasks completed, rule-breaking on the tasks, and maximum amount of time spent on a subtask. Subtest scores are converted to standard scores. The total standard score was used in the statistical analysis of the BADS.

2.3.1.1. Symptom scales.

Brief Psychiatric Rating Scale (BPRS) [39]: The BPRS is used to evaluate psychiatric symptoms such as depression, anxiety, unusual thought content, and hallucinations. This study used a 16 item version of the scale that yields a total score.

Young Mania Rating Scale (YMRS) [15]: An eleven item clinician-administered rating. Scale with high inter-clinician reliability, validity and sensitivity. It is able to differentiate statistically patients before and after two weeks of treatment and to distinguish levels of severity based on a global rating.

2.3.2. MRI scan procedures

MRI studies were performed on a 1.5 T Sigma Imaging System. The MRI Identifiers were removed in accordance to HIPAA regulations. Prior to the procedure the subject took an X-ray if it was reported that any metal device (e.g., pacemaker, prosthesis, metal shrapnel, etc.) was implanted in his or her body. An X-ray was not performed if a subject did not report a metal device (i.e. pacemaker, prosthesis, metal shrapnel, etc.). The MRI laboratory has developed standard protocols to measure ROI required for this study. All morphometric evaluations were conducted on untransformed coronal 3-D images using the National Institute of Health (NIH) image software version 1.62. The following structures were quantified: total intracranial and brain volume, dorsolateral prefrontal and hippocampal volume, total gray and white matter volume for the parietal and orbitofrontal cortex, the superior temporal and cingulate gyrus, amygdala, caudate, putamen, thalamus, and cerebellum. Both regions of interest (ROI) and voxel-based morphometric approaches were utilized (VBM). All measurements were conducted in the coronal plane by a trained and reliable rater blind to subject identity, age, and diagnosis based on a methodology used by our group. Dorsolateral prefrontal cortex was measured on the basis of 10 slices in the coronal plane starting one slice anterior to the centrum semiovale. Each MRI slice was segmented into CSF, gray matter, and white matter compartments using a semi-automated image analysis technique developed by Lim and Pfefferbaum [26,38]. For purposes of this study, only gray matter volumes in the frontal lobes and hippocampus are presented here. These regions were hypothesized to show differences.

2.4. Data analysis

Descriptive data were obtained for all variables used in the study including means and standard deviations for continuous data, and medians, modes and ranges for ordinal data. Comparisons were made between the bipolar disorder and bipolar disorder comorbid with alcoholism groups for the SUMD summary scores, the neurocognitive and the MRI data using t-tests because these procedures were scored on continuous scales.

To examine the strength of association between SUMD scores and cognitive function, symptom, and MRI data linear multiple regression analyses were conducted. The neurocognitive measures included in the analyses were number of perseverative errors and categories achieved from the WCST, total standard score for the BADS, and subtest and the Full Scale IQ scores from the WASI. For the MRI, gray matter volume for the right and left frontal regions and hippocampus were used. Symptoms ratings were for the YRMS and BPRS scales. Analyses were conducted using direct entry and stepwise methods, but in the great majority of cases the default criteria for entry of variables were not met, eliminating the possibility of doing stepwise analyses. The dependent measures in the regression analysis were the total SUMD Current Awareness and Attribution Scores and Item 1 that inquires in general terms about whether the participant believes she or he has a mental disorder, psychiatric problem or emotional difficulty. Item 1 does not have an attribution score.

Table 1
Descriptive data: medians, modes and ranges for the SUMD average scores, BPRS and YMRS.

	Median	Mode	Range
SUMD[1]			
Current Awareness	1.857	.8	.5–5.5
Current Attribution	1.8	1.0	.5–4.67
Item 1 (General Awareness)	1.0	1.0	1-3
BPRS			
Somatic Concern	2	1	1–5
Anxiety	3	2	1–6
Emotional Withdrawal	1	1	1–4
Conceptual Disorganization	1	1	1–4
Guilt Feelings	1	1	1–5
Tension	2	1	1–4
Mannerisms and Posturing	1	1	1–1
Grandiosity	1	1	1–6
Depressed Mood	2	1	1–7
Hostility	2	1	1–5
Suspiciousness	2	1	1–6
Hallucinatory Behavior	1	1	1–3
Motor Retardation	1	1	1–3
Uncooperativeness	1	1	1–4
Unusual Thought Content	1	1	1–5
Blunted Affect	2	1	1–4
Mean Score	28.5	27	18–57
YRMS			
Elevated Mood	0	0	0–3
Increased Motor Activity/Energy	0	0	0–3
Sexual Interest	0	0	0–2
Sleep	0	0	0–3
Irritability	2	2	0–4
Speech Rate and Amount	2	0	0–6
Language-Thought	1	2	0–3
Content of Plans	0	0	0–8
Disruptive-Aggressive Behavior	0	0	0–4
Appearance	0	0	0–2
Insight	0	0	0–4
Total	10	0	0–28

3. Results

3.1. Descriptive data

Descriptive data for the total sample for the SUMD, the BPRS and the YRMS variables, all of which are on ordinal scales are presented in Table 1. Interpreting the SUMD findings the mode and median SUMD scores for current awareness, current attribution and general awareness lies in ranges between clearly and somewhat aware. There are values less than 1 because the lower extreme score for the SUMD is zero. The SUMD scoring system is ambiguous concerning a zero score interpreting it as meaning that the information is not available or it is irrelevant. In the present study the data were recorded treating a zero as a real score rather than missing information. We would therefore stipulate that this procedure would favor obtaining a score indicating absence of denial. The small number of 5 responses indicating clear denial would support that view. For all 20 items no more than 5 (approximately 14%) participants gave a response of 5, indicating complete unawareness or incorrectness. The current attribution measure indicates that there was a strong tendency for participants to attribute their symptoms to a mental disorder. However there were wide ranges for both scores indicating that some participants were unaware of a symptom or incorrect about it being related to a mental disorder.

Looking at the first three SUMD items that inquire about general awareness of illness, effects of medication and social consequences the mode scores were 1, indicating full awareness. Only 2 participants obtained a score of 2 for general awareness, indicating a point between aware and somewhat aware. However, with regard to medication, 10 participants made ratings of 2 or higher, indicating a range going from between uncertainty about the helpfulness of medication to 5 indicating the medications were not helpful. Three participants gave a 5 rating. The majority of participants (54%) clearly believed that there were social consequences related to the mental disorder.

For the BPRS a total score of 31 is the suggested cutoff for mildly ill with higher scores reflecting more severe illness [39]. The mean obtained in the present study of 28.5 is therefore within the normal range. With regard to the individual items, the mode scores of 2 or higher, reflecting mild or more serious illness were obtained only for the anxiety item. The YMRS only yielded pathological level scores for the irritability and language-thought disorder items.

Descriptive data for the neurocognitive and MRI variables are presented in Table 2. While normative data for the MRI are not available, the scores on the neurocognitive tests indicate that there is a large amount of variability, but the sample is of average intelligence. On the WCST, a score of 13 perseverative errors falls at the 50th percentile for the age and education appropriate normative group. Our group obtained mean of 19 errors, while higher than this value is about one half of a standard deviation from that of the normal sample reported in the test manual. The mean standard score on the BADS of 90 is in the low end of the normal range of standard scores Therefore, it would appear that the neurocognitive

Table 2
Descriptive data: means and SDs for the neurocognitive tests and MRI variables.

Neurocognitive tests	M	SD	Range
WASI Verbal IQ	92.06	13.021	72–118
WASI Performance IQ	98.13	12.71	67–119
WASI Full Scale IQ	94.50	12.952	67–117
WCST Perseverative Errors	20.59	11.492	3–50
WCST Categories	3.75	2.032	0–6
BADS Total Standard Score	85.88	16.206	32–109
MRI Volumes			
Left Hippocampus	729.61	66.227	616–836
Right Hippocampus	654.94	63.104	537–769
Left Dorsolateral Prefrontal	4339.00	670.252	2993–5497
Right Dorsolateral Prefrontal	4912.85	719.206	3378–5847
L Orbitofrontal	12078.48	1375.355	9019–13515
R Orbitofrontal	11475.87	1536.157	7943–13632
Total Brain Volume	623138.36	60267.87	522413–705102

functioning level of the present sample is at the low end of average function.

3.2. SUMD, neurocognitive and MRI comparisons between participants with and without

3.2.1. Comorbid alcoholism

SUMD data comparing the subgroups with and without comorbid alcoholism are presented in Table 3. None of the subgroup differences were statistically significant, indicating that the hypothesis that there was a greater degree of unawareness in one subgroup relative to the other was not confirmed. Comparisons on the neurocognitive tests and the MRI findings between the groups with and without comorbid alcoholism are presented in Table 4. It is noted that the mean scores and group differences were in the direction of the non-alcoholic group having a greater degree of unawareness, but the small sample in this group makes this finding difficult to interpret. Non-parametric ranking tests were run to evaluate this matter, but neither the Mann-Whitney test nor the Kolmogorov-Smirnov test yielded significant differences ($p < .05$). Descriptive MRI data were collected to evaluate differences between subjects with and without comorbid alcoholism, but no significant differences were found.

3.3. Multiple regression analyses

Since no significant differences were found between the groups with and without alcoholism, they were combined and a regression approach was taken to the data seeking associations among variables in the entire dataset. Regression data evaluating the association between SUMD and the neurocognitive, symptom and MRI variables are presented in Table 5. In this table analyses are summarized for three dependent variables (SUMD Current Awareness, SUMD Current Attribution and SUMD Question 1 assessing general awareness of mental disorder). The independent measures are strings of cognitive, MRI, BPRS, and YMRS variables. Thus each analysis involved one of the dependent variables and one of the independent variable strings. The direct entry method was used initially, and if default options permitted, stepwise analyses were conducted.

For the SUMD Current Awareness dependent variable, the only significant F-ratio was for the YMRS variables providing an adjusted r^2 of .637. The stepwise analyses entered the YMRS items concerning insight, irritability, and sleep disturbance in that order. The SUMD Attribution score dependent measure did not produce any significant adjusted r^2s. Default criteria were met for the BPRS and YMRS variables. For the BPRS, the hostility and hallucinatory experiences items were entered in that order; for the YMRS, the insight item was entered. For the SUMD general awareness question used as a dependent variable none of the r^2s were significant, but default criteria were met for BPRS variables. Items entered were motor retardation, somatic concern and guilt feelings in that order.

This pattern of results would indicate that within this range of minimal to mild tendency to be unaware of mental disorder, the best predictors of unawareness appear to be variables related to psychopathology. In particular, the YMRS an instrument that assesses manic behavior was the best predictor of degree of unawareness. In effect the more prominent the mania, particularly in regard to lack of insight, irritability, and sleep disturbance, the greater the unawareness. This result receives some support from the BPRS for which the best predictor of current unawareness and attribution is the hostility scale. For the SUMD Attribution score the best predictor is hostility, possibly associated with the irritability item on the YMRS. Thus one reasonable

Table 3
SUMD current awareness and attribution ratings in subgroups with and without alcoholism comorbidity[1].

Variable	Alcoholic		Non-alcoholic		Combined	
	M	SD	M	SD	M	SD
Current Awareness	2.172	1.676	2.846	1.624	2.489	1.65
Current Attribution	1.502	.97	2.495	1.221	1.849	1.127
General Awareness (SUMD Question 1)[2]	1.24	.539	1.57	.787	1.32	.612

[1] Current Awareness and Attribution scores = sum of ratings of individual items on a 1–5 scale divided by number of items completed. Higher scores indicate greater unawareness or incorrectness of attribution. None of the differences between the alcoholic and non-alcoholic groups are statistically significant ($p < .05$).

[2] SUMD Item 1 evaluates if the subject in the most general terms believes that s/he has a mental disorder, psychiatric problem or emotional difficulty.

Table 4
MRI and neurocognitive and MRI differences in hippocampus and frontal regions between groups with and without alcoholism comorbidity.

Neurocognitive Tests	Alcoholic (n = 25)		Non-alcoholic (n = 8)			
	M	SD	M	SD	*t*	*P*
WASI Verbal IQ	90.90	13.27	91.71	11.95	−.143	.887
WASI Performance IQ	97.05	10.24	100.57	15.46	−.685	.500
WASI Full Scale IQ	93.20	11.94	95.71	13.54	−.464	.647
WCST Perseverative Errors	21.05	11.54	16.43	11.28	.917	.368
WCST Categories	3.75	2.15	4.29	2.22	−.563	.578
BADS Total Standard Score	85.60	12.78	82.29	24.13	.465	.646
MRI						
Left Hippocampus	717.73	58.88	757.34	79.60	−1.243	.230
Right Hippocampus	633.34	53.06	705.34	58.80	−2.697	.015
Left Dorsolateral Prefrontal	4324.30	662.02	4373.29	752.05	−.146	.886
Right Dorsolateral Prefrontal	4861.72	680.78	5032.14	858.01	−.476	.640
Left Orbital Prefrontal	11934.93	1219.34	12413.43	1769.20	−.703	.491
Right Orbital Prefrontal	11358.41	1325.25	11749.94	2066.90	−.512	.615

conclusion would appear to be that within this mild range, increased anger is associated with increased unawareness and false attribution.

4. Discussion

The most striking finding of this study would appear to be that apparently contrary to the prevailing literature, the participants in this study, all of whom had well diagnosed bipolar disorder, rarely showed evidence of unawareness of illness as assessed by the SUMD, a detailed procedure designed to make such an assessment. The findings for attribution were typically in the same range as those found for awareness. Most participants, with a small number of exceptions, were aware of their symptoms and correctly related them to a mental disorder. Possibly because there was no indication of substantial impairment of awareness in this

Table 5
Multiple regression analyses for current awareness and attribution scores and general awareness of mental disorder.

	Enter R	r^2	F	p	Stepwise R	r^2	F	p
Current Awareness Total Score								
Neurocognitive Variables	.429	.078	1.733	.188				
MRI Variables	.578	.334	.753	.623				
BPRS Variables	.834	.237	1.518	.256				
YRMS Variables	.795	.632	2.499	.047	.706	.499	7.953	001
Current Attribution Total Score								
Neurocognitive Variables	.466	.115	2.125	.125				
MRI Variables	.446	−.336	.372	.879				
BPRS Variables	.825	.201	1.420	.292	.608	.370	6.750	.005
YRMS Variables	.737	.228	1.724	.156				
General Awareness of Disorder SUMD Question 1C								
Cognitive Variables	.506	.159	2.636	.074				
MRI Variables	.618	−.030	.927	.519				
BPRS Variables	.852	.726	1.763	.184	.521	.272	10.373	.00
YRMS Variables	.668	.446	1.169	.377				
Variables Entered in Stepwise Analyses								
Current Awareness								
BPRS Variables	Hostility							
YRMS Variables	Insight, Irritability, Sleep							
Current Attribution								
BPRS Variables	Hostility, Hallucinatory Experience							
YRMS Variables	Insight							
General Awareness								
BPRS	Motor Retardation, Somatic Concerns, Guilt Feelings							

sample, hypotheses concerning relations among the SUMD, symptoms, the cognitive tests, and the MRI measures were generally not supported. Such confirmation would require study of individuals with a wide range of level of awareness. Furthermore hypotheses concerning the relationships between degree of unawareness and possible contributors to its development including comorbid alcoholism, cognitive dysfunction and structural reduction of gray matter in the frontal region and hippocampus, did not appear to be associated with degree of unawareness. An apparent reason for this result is that the sample did not reflect a continuum of unawareness from aware to significantly unaware, the modal score for the SUMD generally being 1, reflecting awareness. It is noted that for the general item asking about belief concerning having a mental disorder, the mode response is 2, representing being unsure about having a disorder.

The discrepancy between the present study and the available literature may be more apparent than real. For example, in the Pini et al. study [10] the mean score for the Current Awareness SUMD item 2.04 (SD = .8) while in the present study it was 2.14 (SD = 1.67), very similar values reflecting uncertainty with regard to whether one has an illness. The scores for the SUMD individual symptom items are all in the 2 range, reflecting uncertainty. Thus, there appears to be a good degree of consensus among studies found when the actual data are compared.

Considering the results of the present and possibly other studies across methods of evaluation used, it would appear that patients with bipolar disorder who are predominantly euthymic, relatively asymptomatic, and cognitively reasonably intact, do not have prominent current unawareness, but may be uncertain as to whether or not they have a mental disorder. The presence of comorbid alcoholism seems to have no apparent influence on the SUMD scores, with non-significant differences between the comorbid alcoholism and non-alcoholism groups. Multiple regression analyses were accomplished to evaluate the strength of association between the Current SUMD scores and the neurocognitive, MRI and symptom severity variables. Such an analysis was meant to assess whether or not even in the absence of apparent lack of insight there is a more subtle association between these variables.

A limitation of this study with regard to the MRI is the absence of normative data. While collection of such data would have gone beyond the scope of the study as proposed, different findings would be anticipated if the data reflected a range of values going from clearly abnormal to normal from what would be the case if all the results were uniformly normal in the age group studied. Further research might productively obtain a normal age and gender matched sample to evaluate this consideration. Nevertheless, the study was able to address the issues of insight in patients with bipolar disorder, relations with neurocognitive function, symptom status. Relationships with alcoholic comorbidity have also been addressed. The severity of mania may be associated with level of unawareness. The total YMRS score was significantly correlated ($r = .48$; $p < .01$) with the SUMD current awareness score. The findings of this study indicating limited impairment of insight evaluated with a sophisticated measure suggest the need for further investigation of differences between the present and other studies.

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